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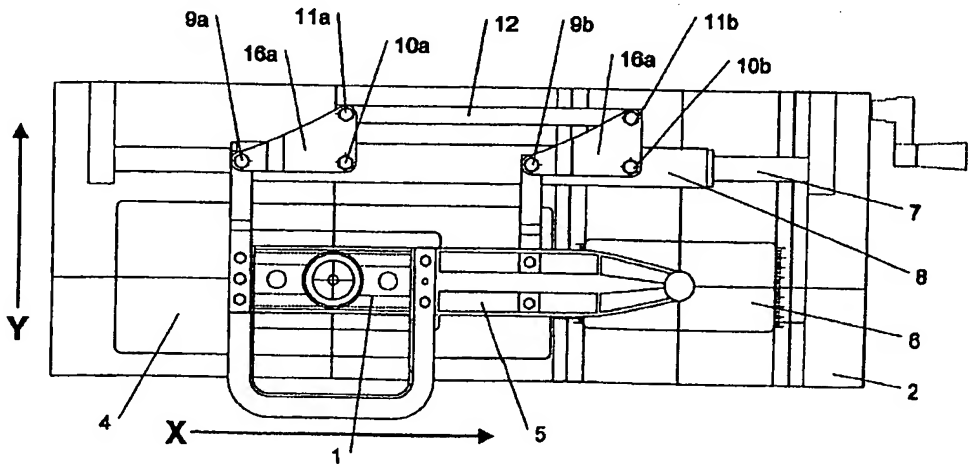
(54) Title: ROUTER ATTACHMENT



(57) Abstract: A router attachment to enable the controlled cutting of groove, shapes etc. and the accurate forming of joints such as mortice and tenon joints, the movement of the router being controlled by pairs of rotating plates and struts with four or more pivot points all being constrained to move as parallelograms and with a pattern mounted in the attachment offset to the workpiece that is followed by a guide pin connected to the router so that the router cuts a shape in the object being worked corresponding to that of the pattern.

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Router Attachment

The present invention relates to attachments. More particularly, the present invention relates to adjustable attachments which can be used with routers making them safer and more effective.

A router is a tool which is used for cutting precise edges, grooves or shapes in a workpiece. Although there are guide mechanisms known in the prior art which permit a straight or curved cut or groove to be made in a workpiece, problems arise when one is faced with the task of making a plurality of identical grooves in parallel along the length of a workpiece or an array of identically positioned grooves in a sequence of workpieces and other problems arise with more complex structures such as mortice and tenon joints.

In a typical straight or curve line cutting guide, the workpiece is clamped securely to the guide and the required cut is made. In order to make additional cuts parallel to the first the workpiece must be loosened within the guide for each cut and must be manually measured, marked, and repositioned, in order to line up properly with the preceding cut. This procedure is time consuming and subject to operator error as each cut is essentially a distinct operation. The opportunity exists for cumulative error to be introduced, which results in non-parallel or irregular spacing. Several U.S. patents have issued which offer guides for routers. Most of these prior art devices lack the necessary flexibility, adaptability, and variety of applications.
US Patents 4966507, 4434824, 4281604, 4630657, 4215731 describes such guides.

A particular problem arises when it is desired to cut mortice and tenon joints. The utilization of mortice and tenon joints is well known in the art, particularly in the creation of wooden furniture. The prevalence of such joints has led to various methods and apparatuses for creating mortices and tenons. The quicker methods take

advantage of power tools such as routers. The router bit is guided around a piece of wood to shape the desired tenon. Attachments for guiding routers are described in US patents 4,479,523 4; 4,749,013 and 5562136.

There are templates provided for use with routers in which the template has a cut out part to the shape required, the template being positioned over the workpiece, the router blade is guided by the template so that the desired shape is cut. However it is very easy for the router blade to damage the template especially when the width of the groove is close to the diameter of the cutter. The use of larger diameter guide bushes help prevent damage to the templates, but these in turn require the shape in the template to be larger than the shape being cut by an offset equal to the difference between the diameters of the cutter and guide bush. With simple shapes this is often not a problem, but with complicated and intricate shapes this offset dimension produces inaccuracies in the shape being cut. The greater the offset the greater the effect on the final shape.

None of the prior art sufficiently addresses the need for a simple and versatile attachment for a router which can cut a wide range of shapes using a pattern that is the same size as the final shape required and including both pieces of mortice and tenon joints.

I have now invented an improved attachment for use with plunge routers and portable vertical drilling machines. This improved attachment uses a guide pin running in a pattern positioned alongside the workpiece, to guide the movement of the cutter, rather than a template set between the router and the workpiece.

To overcome the forces involved in causing a router to follow a preset course as set by a pattern positioned a distance away from the workpiece the invention uses a series of rotating struts or plates with or without horizontal sliders to ensure that the router

and guide pin running in the pattern are maintained in the same orientation throughout all movements of the router.

According to the invention there is provided a router attachment which comprises a movable carriage which can hold a router and a guide pin, which carriage is attachable to a router base plate by a controlling attachment means so that a router held in the carriage is able to move in two orthogonal directions (X and Y directions) and in which the attachment means comprises a pair of spaced apart components which are either fixed relative to the base plate or are able to move relative to the base plate in one direction (the X direction) the two components being constrained to move at a constant relative angular rotation to each other about a pair of pivot points, each component is pivotally connected to a connector which is connected to the carriage and which, when the component is fixed relative to the base plate, is pivotally connected to the carriage.

The simplest method of maintaining the fixed relative orientation between the components is with the use of link bar or bars of the same length which connect each of the pair of components to each other. Lines between matching pivot points of each part of the respective pairs thus form a parallelogram whatever the position of the carriage.

Depending upon the configuration the controlling mechanism would generally consist of:-

1. Pair of rotating plates mounted on pivot points combined with means of horizontal sliding of the pivot points.
2. Pair of rotating plates combined with pair of rotating struts connected to the carriage.

Either of these combinations allow the router carriage to move freely within specific limits in the X and Y directions whilst maintaining fixed angular rotation.

The component can be in the form of a plate which, when the component is fixed relative to the base plate is connected to the base plate about a pivot point and connected to the carriage by a further pivotal connection.

In one embodiment where the components can move relative to the base plate each component is pivotally and slidably connected to a bar attached to the router base plate so they can move along the bar slidably whilst being held a fixed distance apart. These pivot points can be held a fixed distance apart by being attached to a sleeve slidably mounted on the bar.

The bar can be in the form of a rod or a similar structure which can either permit rotation of the sleeve thereby allowing the router cutter to be rotated vertically clear of the base or, if sleeve is restrained from rotating, the carriage and router complete can be removed clear of the base with the use of detachable mounting pins and or sockets.

In use when the component is fixed relative to the base plate movement in the X direction is about a pivot point and there will be some compensatory movement in the Y direction so linear movement is achieved and vice versa for movement in the Y direction.

The base plate preferably comprises a moulded or machined plate with a recess and perforation through formed in it, preferably there is a movable carriage which holds the router and guide pin. The carriage has an extended block below the main plate holding the router columns thereby lowering the point of router support and extending maximum projection of the cutter into the workpiece. The block sits within the recess and limits overall movement of the carriage, whilst the perforation allows the cutter to pass through the base into the workpiece located below. The carriage is movable connected to the controlling mechanism by either fixed arms or

detachable couplings. This enables the carriage and router to be rotated vertically clear of the recess or removed from the base.

The router base can be a movable base or it can be a base fixed to a workbench or other equipment.

Components to the side of the bar remote from said recess in order to give a greater range of movement i.e. the component can move over and/or under the bar to give a greater range of movement.

There is preferably a second recess for an adjustable pattern holder, which holds the pattern firmly and enables it to be moved relative to the base to achieve fine adjustment in positioning of the pattern within the recess and with respect to the workpiece as well as allowing a series of parallel cuts or grooves to be made.

It is preferable that the guide pin diameter be varied to match or relate to the diameter of the cutter being used. The pin is therefore slidably mounted in the vertical direction within a holder attached directly to the carriage. In general operation the mounting height will depend upon the thickness and construction of the pattern, and be locked during any particular routing operation. Where the plunge depth of the router is being controlled by the attachment/device from the shape of the pattern the guide pin may be allowed to slide vertically thereby following the contours of the pattern.

By keeping the attachment secured in the same position over a workpiece and by changing the pattern and or cutter complex shapes can be machined not possible with existing jigs.

Preferably the pivots forming the pivot points are detachable so that the router plate can be removed; this enables a range of routers or similar tools to be used with the

attachment and enables the router to be easily removed from the attachment. Alternatively the carriage can be rotated clear of the base.

Routers can be used to drill a series of vertical holes in a workpiece for dowels but up to now positioning has been difficult with the smaller sized holes used for dowels due to the likelihood of damaging the pattern. The use of guide bushes effectively limit the minimum distance between holes. It is not necessary to have the cutter the same size as the dowel it can be smaller. Where many dowel holes are required the router could be replaced with a vertical drill attached to the holding plate.

The attachment can be held on a work bench by conventional holding devices or can be secured to a "Workmate" type work bench with the jaws of the "Workmate" being used to hold the workpiece. Alternatively the attachment can be clamped to the piece to be worked by means of clamps such as G clamps; this is useful with large objects such as kitchen units and doors.

Preferably there are means whereby the router cutting bit can be raised and lowered into the material to be worked so that the depth of cut can be controlled. This facility is already incorporated in the standard plunge type router.

Alternatively where it is required that the cutter depth be varied in relation to different levels or contours within the pattern automatic depth control could be included within the router holding device that would raise or lower the cutter according to information received from an electronic sensor mounted within the guide pin or directly from the vertical movement of the guide pin. The vertical movement of the cutter could the be magnified by a servo mechanism or similar device.

It is a feature of the invention that, with the guide pin spaced apart from the router, a wide variety of shapes and patterns can be made, unlike in prior art devices where the

router cutting blade is constrained within a groove or shape etc cut in a plate attached to the material to be worked.

When the router plate is rotatably attached to the bar e.g. via a sleeve, the carriage can be rotated about the bar and so lifted away from the base plate The router can be locked in position at any angle in relation to the base plate so that angled grooves etc. can be cut, in addition this embodiment enables the router blade to be easily changed without removing the attachment from the material being worked.

There can be clamping arrangements used with the attachment of the present invention which facilitates the attachment being used with a range of size of objects and applications.

In use the material to be worked on e.g. a door into which a lock is to be inserted or into which hinges are to be attached, is clamped to the device. A pattern for the size of slot into which the lock is to be inserted is positioned under the guide pin, the door is fixed so that the location of the router is above the edge of the door where the lock is to be inserted. The router is started and lowered into contact with the door and the guide pin guided over the pattern so that the router blade cuts a slot in the door of the right dimensions.

When a hinge is to be attached to a door, the edge of the door is positioned under the router and a pattern of the hinge dimensions fixed under the guide pin so that, as the guide pin moves over the pattern, the right shaped cut out is formed in the door to receive the hinge. In both cases the depth of cut is controlled by the moving router cutter as in conventional routers.

With the present device it is possible to use smaller diameter cutters than possible with existing jigs. This gives much smaller internal radii to corners allowing the

attachment to cut hinge recesses for standard rectangular hinges and the like with very little manual finishing.

The attachment can be used with a router to cut for example a mortice and tenon joint, in which case the same pattern can be used for cutting the mortice and the tenon, so that to cut the mortice the guide pin is moved around the outside of the pattern and, to form the mortice, the guide pin is moved around the inside of the pattern. This should produce a mortice and tenon which fits exactly. Alternatively the pattern consists of a plate with a slot formed in it corresponding to the size of the mortice with a removable plug in it which corresponds to the tenon. With the plug out or lowered below the surface of the plate a mortice can be cut and with the plug raised and the guide pin following round the plug the tenon can be formed. It is important that the plate can be turned over both left to right and top to bottom so that cuts make matching pairs or where cuts are made at an angle to the plate can be exactly matched.

By using rotating plates rather than slider mechanisms it is possible to scale up the device for mounting on to a workbench allowing very much larger patterns and workpieces to be used without serious friction problems with slider mechanisms caused by the rotation forces between the guide pin and cutter especially when in use in dusty environments.

It is well known that when a router is used there is considerable problem due to the vibration of the cutter. This is exacerbated when cutting harder materials or cutting a slot of the same width as the diameter of cutter especially with smaller routers. This necessitates that the depth of cut of each pass is strictly limited, requiring many passes to achieve the desired depth. With this invention by increasing the guide diameter above the diameter of the cutter it is possible to make a rough cut smaller than the desired shape. Then by replacing the guide pin to match the cutter a small

slither can be removed around the shape in one final pass thereby greatly improving the surface finish and removing the problem of cutter vibration.

There is no need for the guide pin to be made from high strength materials except where the diameter is very small, generally the guide pin can be made from standard diameter extruded aluminium rod with the end part turned to the required diameter. This low cost solution permits a wide range of guide pin diameters to be held, thereby allowing tight control on tolerances to be achieved, by simply changing the guide pin diameter. There is no need to remove the carriage from the device in order to change the guide pin and so achieved the desired tolerance.

A guide pin with diameter greater than cutter by 0.01mm will decrease a mortise dimension by 0.005mm for each face i.e. 0.01mm overall. When cutting a tenon the same combination increases the dimension on the component by the same amount. Using this offsetting effect would be also possible to cut complex shapes replicating release tapers complete with internal and external radii as seen with injected moulded plastic components, by using a single pattern combined with different cutters and guide pins of different diameters.

This would allow a router combined with this simple attachment to produce prototype complicated moulded plastic components without the need of CNC equipment and or extensive hand finishing.

An embodiment of the invention is described in the accompanying drawings in which

Fig. 1 is a side view of a attachment and router

Fig. 2 is a plan view of a attachment and router

Figs. 3 shows end views of the embodiment of fig. 1

Fig. 4 shows details of the pattern holding and positioning arrangement and

Fig. 5 shows a plan view of a different embodiment of the invention

Referring to figs. 1 2 and 4 a base plate (2) has a recess (4) in it, a router (1) is held in holder in carriage (3) over recess (4). There is an arm (5) fixed to holder (3), which arm is attached to guide pin (13). There is a pattern recess (6) in which a pattern can be fixed so that guide pin (13) can move within or round the pattern. The holder (3) is attached to plates (16a) and (16b) pivot points (9a) and (9b). The plates (16a) and (16b) are attached to sleeve (8), slidably and rotatably mounted on bar (7), at second pivot points (10a) and (10b). There is a bar (12) connected to plates (16a) and (16b) at pivots (11a) and (11b).

The plates (16a) and (16b) are parallel to each other and the pivot points (9a), (9b), (10a) and 10b) are at corners of a parallelogram.

Referring to fig. 5 the plates (16a) and (16b) are pivotally mounted on base plate (2) at (10a) and (10b) and the arms (18a) and (18b) are pivotally connected to the plates (16a) and (16b) at (9a) and (9b). The arms (18a) and (18b) are pivotally connected to the router plate (3) at (17a) and (17b).

In use a pattern is put in a pattern guide plate in pattern recess (6) and the wood to be worked clamped under recess (4). The router is started and placed in contact with the wood and, as the guide pin (13) follows the pattern, the router will cut out the same shape in the wood. At all times the plates (16a) and (16b) remain parallel. The dimensions of the recess (6) can be varied by means of screw (20) (fig. 4).

As can be seen the movement about the pivots coupled with the ability of the sleeve (8) to slide along bar (7), enables the router to be moved in X and Y directions and so in any direction whilst being firmly and safely held.

Referring to figs. 3a and 3b, in fig. 3a the router is at one end of the recess (4) and as the router is moved towards the other end of recess (4) the holder pivots about the pivot points (with a pivot point shown as (10b) in fig. 3a), until it reaches the position

shown in fig. 3b. Referring to figs. 3c and 3d, the sleeve (8) is rotated about the bar (7), so that the router can be raised away from the recess and in the position of fig. 3d the router blade etc. can be easily changed without detaching the router from the attachment.

Referring to fig. 4 the pattern recess (6) has a pattern guide plate (17) mounted on a shaft (18) using a screw thread (19) so that the pattern guide plate can be controllably moved in the recess. There is scale (20) to facilitate accurate positioning. This enables a pattern mounted on (17) to be positioned in the required position so that with the guide pin (13) positioned on the pattern the router is accurately positioned on the wood being worked.

Claims

1. A router attachment which comprises a movable carriage which can hold a router and a guide pin, which carriage is attachable to a router base plate by a controlling attachment means so that a router held in the carriage is able to move in two orthogonal directions (X and Y directions) and in which the attachment means comprises a pair of spaced apart components which are either fixed relative to the base plate or are able to move relative to the base plate in one direction (the X direction) the two components being constrained to move at a constant relative angular rotation to each other about a pair of pivot points, each component is pivotally connected to a connector which is connected to the carriage and which, when the component is fixed relative to the base plate, is pivotally connected to the carriage.

2. A router attachment as claimed in claim 1 in which the components are pivotally and slidably attached to a bar attachable to the base plate.

3. A router attachment as claimed in claim 1 in which the said components are pivotally attached to a bar attachable to the base plate and cannot slide along the bar.

4. A router attachment as claimed in claim 1 in which the each of the components is pivotally attached to a plate which is pivotally attachable directly to a movable base or mounted on a base fixed to a workbench or other equipment.

5. A router attachment as claimed in any one of claims 2 to 4 in which the pair of components s are able to move to either side of the bar.

6. A router attachment as claimed in any one of claims 2 to 5 in which each of the components are slidably connected to a bar so they can move along the bar whilst being held a fixed distance apart.

7. A router attachment as claimed in claim 7 in which each of the components are attached to a sleeve rotatably and slidably mounted on the bar.

8. A router attachment as claimed in any one of claims 1 to 7 in which each of the components are fixed to the plate and the components extended beyond the point of attachment to the plate and the extended part of the struts or plates connected together.

9. A router attachment as claimed in any one of the preceding claims in which the holding means is attached to a router plate which incorporates adjusting means which enables the router to be positioned in a variety of positions.

10. A router attachment as claimed in any one of the preceding claims in which the router holding means is slidably mounted on a base and is allowed to move within the constraints of a recess in the base.

11. A router attachment as claimed in claim 10 in which the base maintains the router holding means with a vertical separation between sliding parts and a workpiece.

12. A router attachment as claimed in any one of the preceding claims in which the router plate is mounted on a base in which base there is a recess, which is a pattern holder recess, into which a guide plate incorporating the pattern to be followed can be mounted so that the guide pin can follow a pattern positioned in the guide plate.

13. A router attachment as claimed in claim 12 in which the guide pin diameter can be varied to match or relate to the diameter of the cutter being used and the guide pin is slidably mounted in the vertical direction within a holder attached directly to the carriage.

14. A router attachment as claimed in claim 12 or 13 in which there is a second recess for an adjustable pattern holder, which holds the pattern firmly and enables it to be moved relative to the base to achieve fine adjustment in positioning of the pattern within the recess and with respect to the workpiece as well as allowing a series of parallel cuts or grooves to be made.

15. A router attachment as claimed in claim any one of claim 13 to 14 in which the pattern plate comprises a plate with a slot formed in it corresponding to the size of the mortice with a removable plug in it which corresponds to the tenon, with the plug out or lowered below the surface of the plate a mortice can be cut and with the plug raised and the guide pin following round the plug the tenon can be formed.

15. A router attachment as claimed in any one of the preceding claims in which the pivot points are detachable so that the router plate can be removed.

16. A router attachment as claimed in any one of the preceding claims in which there are means whereby the router cutting bit can be raised and lowered into the material to be worked so that the depth of cut can be controlled either manually or automatically via an electronic or other sensing device incorporated within the guide pin or router plate.

17. A router attachment as claimed in claim 15 in which the router plate can be locked in position at an angle in relation to the base plate.

18. A router attachment as claimed in any one of the preceding claims in which there are clamping arrangements to clamp an object to be worked on, in position on the base.

19. A router attachment as hereinbefore described with reference to the drawings.

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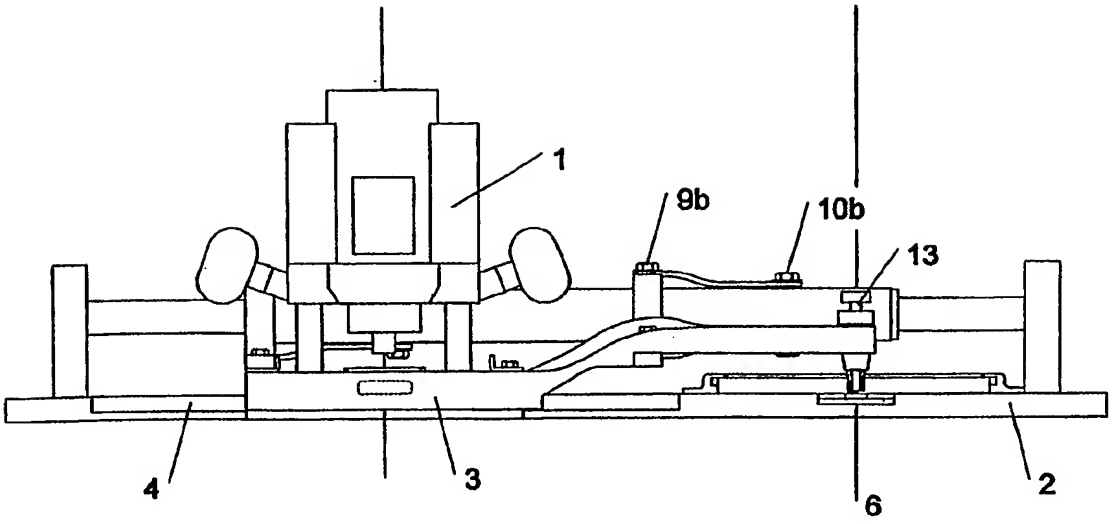

Fig. 1

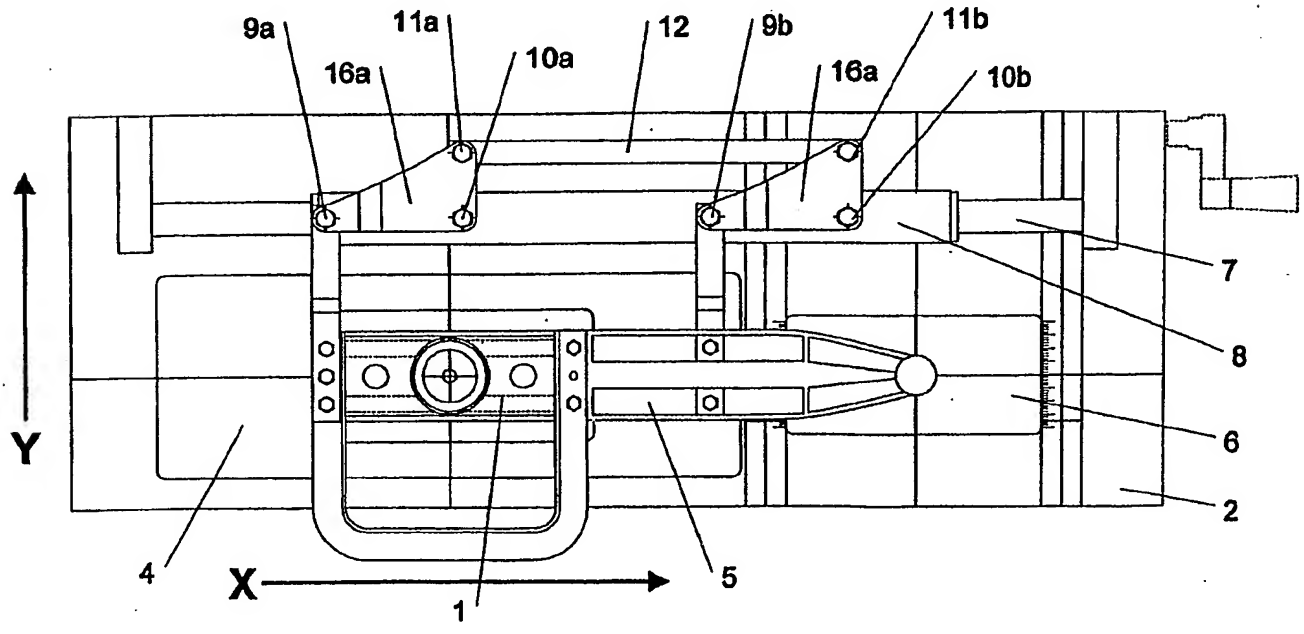

Fig. 2

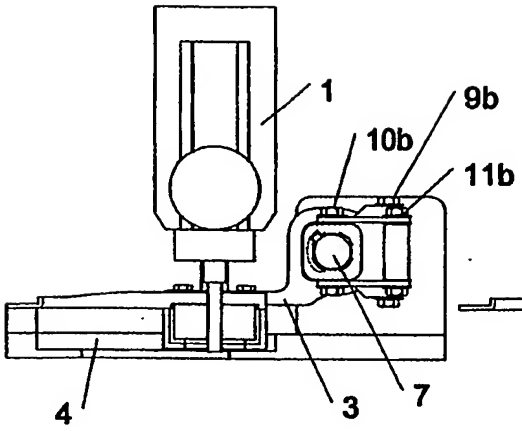

Fig. 3a

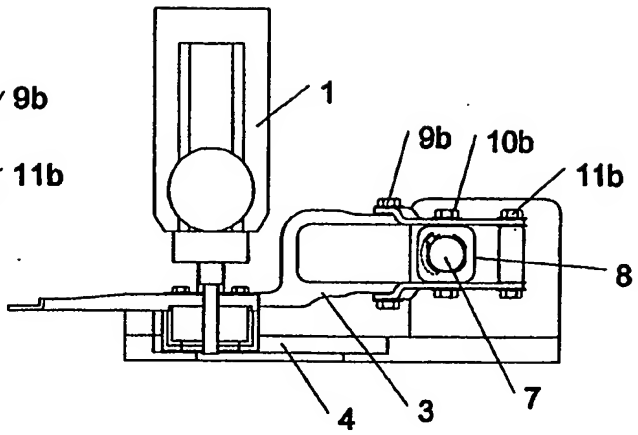

Fig. 3b

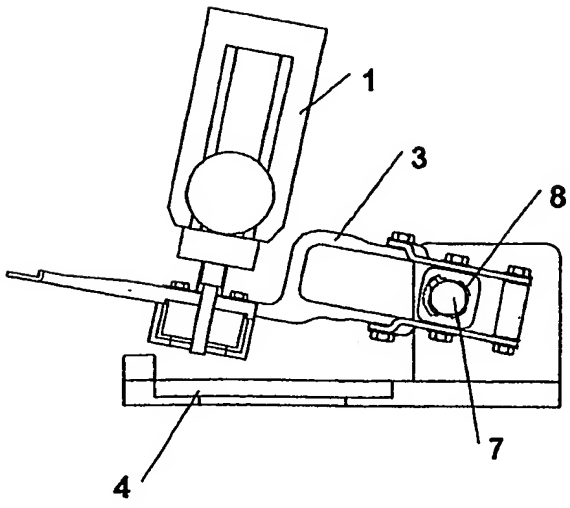

Fig. 3c

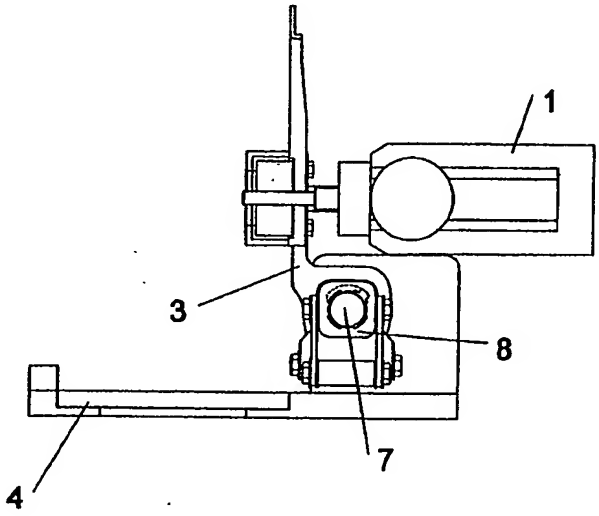

Fig. 3d

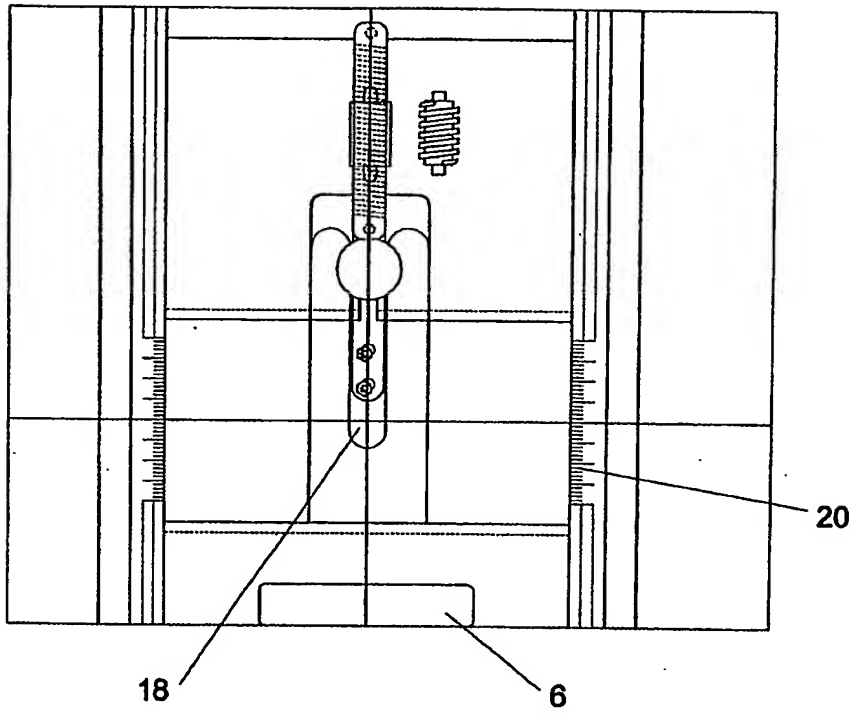

Fig. 4

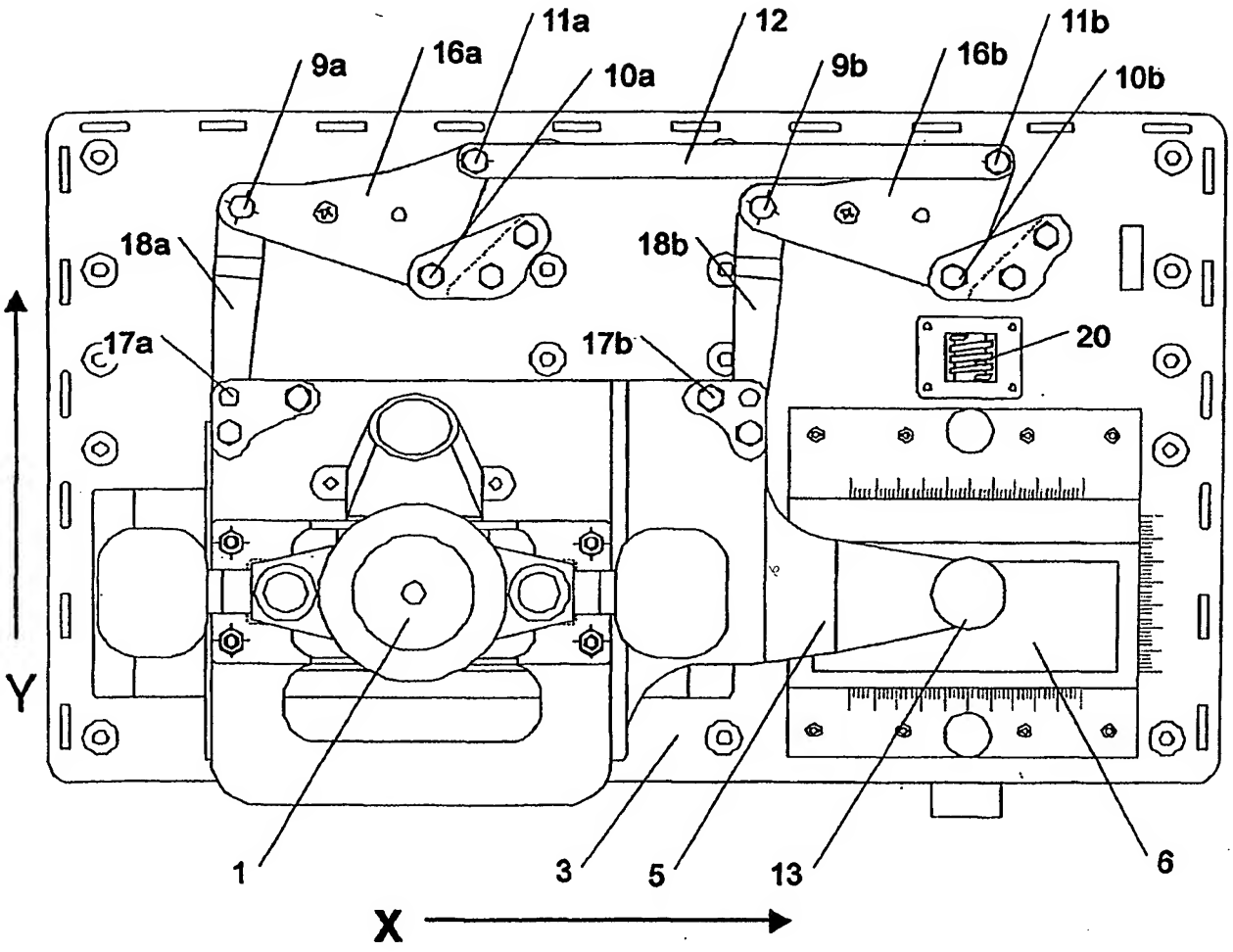

Fig. 5

INTERNATIONAL SEARCH REPORT

Intern ial Application No
PCT/GB 03/00353

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B23Q35/10 B23Q1/54 B23Q1/48 B23Q1/62

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B23Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 301 287 A (EDWARDS ARTHUR T) 31 January 1967 (1967-01-31) the whole document	1
Y	US 5 267 818 A (MARANTETTE WILLIAM F) 7 December 1993 (1993-12-07) the whole document	1,2,4
Y	US 3 171 207 A (WORMSER ROBERT S) 2 March 1965 (1965-03-02) the whole document	1,2,4

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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'A' document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
14 May 2003	27/05/2003

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inter al Application No
PCT/GB 03/00353

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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